



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re Application of  
Teruhiko NAWATA, et al.  
Serial No. 10/717,281  
Filed: 11/19/2003

Group Art Unit: 1754  
Examiner: Ngoc-Yen M. Nguyen

For: AS-GROWN SINGLE CRYSTAL OF ALKALINE EARTH METAL FLUORIDE

The Honorable Commissioner of Patents and Trademarks  
United States Patent and Trademark Office  
Washington, D. C. 20231

Sir:

DECLARATION UNDER 37 CFR 1.132

I, Teruhiko NAWATA, declare and state that:

1. In March, 1989, I was graduated from the graduate course of Kyushu University, Engineering Research Department, majoring in nuclear engineering and received a degree of Master of Engineering from the same University.

Since April, 1989, I have been an employee of TOKUYAMA CORPORATION, and till the present time I have been engaged in the research and development work concerning polymer science, polymer processing and crystal growth.

2. I am a co-inventor of the invention described in the specification of the above-identified application.

3. I carried out the following experiments.

#### Experiment A

Pulling of a calcium fluoride single crystal was carried out in the same manner as in Example 1 of the specification with the single crystal pulling apparatus of Fig. 1 shown in the specification. As a result, an as-grown single crystal of calcium fluoride having a straight barrel part maximum diameter of 28 cm and a weight of 27 kg was prepared. The length of the straight barrel part of the as-grown single crystal was 10 cm.

Measurement of a surface roughness of the as-grown single crystal with the contact surface measuring instrument (manufactured by Taylor Hobson Ltd.) according to JIS B06501 and JIS B0601 resulted in 0.44  $\mu\text{m}$  as an average roughness.

Measurement of a light transmittance of the as-grown single crystal at a wavelength of 632.8 nm resulted in 91.5%.

#### Comparative Experiment B

Growing of a calcium fluoride single crystal was carried out using a high-purity graphite crucible having an inside diameter of 60 mm and a height of 150 mm with the single crystal growth apparatus of the Bridgeman-Stockburger method (Bs method). Measurement of a surface of the crucible with the contact surface measuring instrument (manufactured by Taylor Hobson Ltd.) according to JIS B06501 and JIS B0601 resulted in 15  $\mu\text{m}$  as an average roughness.

The crucible was charged with 500 g of high-purity calcium fluoride and 5 g of lead fluoride as a scavenger. Then, the crucible, to which a top lid having a through-bore of 2 mm diameter was attached, was placed into the single crystal growth reactor. The reactor was vacuumed to  $1 \times 10^{-4}$  Pa and then was heated to 1450°C over 35 hours. After the reactor was maintained at 1450°C for 6 hour, the crucible was pulled down at a rate of 2 mm/hour to crystallize calcium fluoride in the crucible. The resultant as-grown single crystal of calcium fluoride was taken out from the apparatus.

A surface roughness of the as-grown single crystal cannot be measured with the contact surface measuring instrument (manufactured by Taylor Hobson Ltd.) because the lateral face of the as-grown single crystal was very rough.

Measurement of a light transmittance of the as-grown single crystal at a wavelength of 632.8 nm resulted in 5.2%.

#### Comparative Experiment C

Growing of a calcium fluoride single crystal was carried out in the same manner as in Comparative Experiment B as described above, except of using a crucible in which a pyrolytic carbon was deposited on the inner surface of a high-purity graphite crucible having an inside diameter of 60 mm and a height of 150 mm. Measurement of a surface of the crucible with the contact surface measuring instrument (manufactured by Taylor Hobson Ltd.)

according to JIS B06501 and JIS B0601 resulted in 2.1  $\mu\text{m}$  as an average roughness.

The resultant as-grown single crystal had a lateral surface comprising the very rough portion and the relative smooth portion. Measurement of a surface roughness of the relative smooth portion with the contact surface measuring instrument according to JIS B06501 and JIS B0601 resulted in 3.4  $\mu\text{m}$  as an average roughness.

Measurement of a light transmittance of the as-grown single crystal at a wavelength of 632.8 nm resulted in 48.8%.

The undersigned declares further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

*Teruhiko Nawata*

Teruhiko NAWATA

This 19th day of January, 2007